FLOOD INSURANCE STUDY

PASCO COUNTY, FLORIDA

UNINCORPORATED AREAS

REVISED

FEBRUARY 17, 1989

Federal Emergency Management Agency

COMMUNITY NUMBER 120230

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

This publication incorporates revisions to the original Flood Insurance Study. These revisions are presented in Section 10.0.

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1.0 INTRODUCTION

1.1 Purpose of Study

The purpose of this Flood Insurance Study is to investigate the existence and severity of flood hazards in the unincorporated areas of Pasco County, Florida, and to aid in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. Initial use of this information will be to convert Pasco County to the regular program of flood insurance by the Federal Insurance Administration. Further use of the information will be made by local and regional planners in their efforts to promote sound land use and flood plain development.

1.2 Coordination

The following persons or agencies were contacted in an attempt to explore all possible sources of data. Information describing hydrological conditions, drainage patterns and other flood-related data, as well as, information on the topography, roads, bench marks, and demography of Pasco County was sought from:

County of Pasco, Department of Public Works
Florida State Department of Community Affairs
Florida State Department of Transportation
Gee and Jenson Consulting Engineers
Greater Dade City Chamber of Commerce
Greater New Port Richey Chamber of Commerce
National Oceanic and Atmospheric Administration
Seaboard Coast Line Railroad
Southwest Florida Water Management District
Tampa Bay Regional Planning Council
U.S. Army Corps of Engineers, Jacksonville District
U.S. Geological Survey
U.S. Soil Conservation Service

The State Coordinator was involved with this study through the Federal Insurance Administration Regional Office.

An intermediate meeting was held on August 22, 1979. The meeting was attended by representatives of Pasco County, the Federal Insurance Administration, and the study contractor. The purpose of the meeting was to inform the community of the progress of the study and to deliver copies of the draft report.

The results of this study were reviewed at a final community coordination meeting held on September 24, 1980. Attending the meeting were representatives of the Federal Insurance Administration, the study contractor, the Southwest Florida Water Management District, and the county. No problems were raised at the meeting.

1.3 Authority and Acknowledgments

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968, as amended.

The hydrologic and hydraulic analyses for this study were performed by Tetra Tech, Inc., for the Federal Insurance Administration, under Contract No. H-4510. This work, which was completed in May 1979, covered all significant flooding sources affecting the unincorporated areas of Pasco County, Florida.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the unincorporated areas of Pasco County, Florida. The area of study is shown on the Vicinity Map (Figure 1).

Areas not included in the study are the incorporated Cities of Dade City, New Port Richey, Port Richey, Zephyrhills, San Antonio, and the Town of St. Leo.

The following significant sources of flooding in Pasco County were studied by detailed methods: Gulf of Mexico, Anclote River, Duck Slough, Hillsborough River, Pithlachascotee River, and Withlacoochee River.

Those areas studied by detailed methods were chosen with consideration given to all proposed construction and forecasted development through 1984.

Approximate methods were used to study the upstream portions of Anclote River, Duck Slough, Hillsborough River, Pithlachascotee River, and Withlacoochee River. Numerous smaller streams, lakes, and swamps were also studied by approximate methods.

Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to and agreed upon by the Federal Insurance Administration and Pasco County.

2.2 Community Description

Pasco County occupies an area of approximately 772 square miles in west-central Florida. It stretches approximately 22 miles along the Gulf of Mexico from Hillsborough and Pinellas Counties on the south to Hernando County on the north. On the east are Polk and Sumter Counties. Dade City, the county seat, is located approximately 280 miles northwest of Miami, approximately 170 miles southwest of Jacksonville, and approximately 200 miles southeast of Tallahassee.

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

PASCO COUNTY, FL
(UNINCORPORATED AREAS)

APPROXIMATE SCALE

4 0 4 8 12 MILES

VICINITY MAP

The U.S. Bureau of the Census recorded the 1970 population of Pasco County at 75,955, which represented a 106-percent increase over the 1960 census of 36,785 (Reference 1). The current permanent population is estimated to be approximately 135,186, which represents an increase of approximately 78 percent over the 1970 level. The population of Pasco County is expected to increase to approximately 177,000 by 1980 and 225,400 by 1985 (Reference 2).

The majority of developed land in the area is primarily agricultural, mostly cropland and pasture with some citrus groves. Commercial forestry also contributes a substantial percentage to the county economy. Industrial areas are located around the Cities of Dade City and Port Richey. Considerable commercial and residential development exists in areas along U.S. Highway 19 in the western part of the county and along the Seaboard Coast Line Railroad and U.S. Highway 41 in the central part. Recently, development in inland areas of central Pasco County, around Land O' Lakes, has become more extensive.

The major streams within the county are Withlacoochee River in the eastern portion, Hillsborough River in the southeast, Anclote River in the south and west, and Pithlachascotee River in the western and central sectors. Withlacoochee River, which flows northwesterly through the eastern and northern sections of Pasco County from Green Swamp in Polk County to the Gulf of Mexico, is approximately 157 miles in length, with a drainage area of 1980 square miles. Hillsborough River, which also originates at Green Swamp, flows through the southeastern corner of Pasco County southwesterly for approximately 54 miles into Hillsborough Bay at the City of Tampa and drains approximately 690 square miles. North Branch Anclote River flows southwesterly to its confluence with South Branch Anclote River. They form Anclote River, which then flows southwesterly for approximately 21 miles into the Gulf of Mexico. The Anclote River watershed includes approximately 120 square miles. Pithlachascotee River originates near Brooksville in Hernando County and flows southwesterly through Pasco County to the Gulf of Mexico at the City of Port Richey. It drains an area of approximately 195 square miles.

Cypress Creek and other miscellaneous tributaries of Hillsborough River are in the south-central portion of the county. Along with their numerous tributaries, these streams provide a fairly extensive drainage system. Withlacoochee River overflows into Hillsborough River at an overflow channel near the Town of Richland. In addition, there is a network of canals and ditches to drain some of the low flat areas. Several small creeks in the coastal portions of the county drain several miles inland. Tidewaters extend several miles inland into these coastal streams and into Pithlachascotee and Anclote Rivers.

Physically, Pasco County is divided into two topographic regions, the Coastal Lowlands and the Central Highlands, and is characterized by gently sloping terrain, with level or nearly level areas in the western section, and higher, gently rolling areas and shallow depressions in the eastern portion of the county. Numerous ponds and lakes are located throughout the county, and sinkholes are scattered throughout the north and central parts. These retain a large part of surface drainage.

The elevation in the study area ranges from approximately 250 feet in the north-central parts to sea level along the gulf coast. The Anclote Keys, in the extreme southwest of the county, are low-lying offshore barrier islands. North of these keys there is an indistinct salt marsh shoreline averaging 1 to 2 feet in elevation.

Pasco County is located in the subtropical climatic zone, which is characterized by mild, dry winters and warm, wet summers. The wet seasons extends from June through September and coincides with the hurricane season. During this 4-month period, the study area receives nearly two-thirds of its annual precipitation. The average annual precipitation in the study area is approximately 54 inches, and the average annual temperature is approximately 72°F. The average annual runoff for basins in Pasco County is approximately 7 inches per year, with the exception of the Anclote River basin which averages approximately 15 inches per year (Reference 3).

Vegetation in the study area is typically subtropical, with cypress swamps in the flat, poorly drained areas in the central parts of the county, marshes and mangroves along the coast, and pine, palm, and live oak in the higher areas.

2.3 Principal Flood Problems

Flooding in Pasco County results primarily from tidal surge in the coastal areas of the county caused by hurricanes and tropical storms, and from overflow of the streams caused by rainfall and runoff. Not all storms which pass close to the study area produce extremely high tides. Similarly, storms which produce extreme conditions in one area may not necessarily produce critical conditions in other parts of the study area.

Pithlachascotee and Anclote Rivers are broad estuaries and, under certain conditions, tides generated at their mouths in the Gulf of Mexico can intrude far upstream. Rainfall which usually accompanies hurricanes can aggravate the tidal flood situation. Because of the flatness of the terrain along the streams and rivers, most inland areas are characterized by shallow flooding during heavy rainfall.

Storms passing Florida in the vicinity of Pasco County have produced severe floods, as well as, structural damage. A brief description of several significant tropical storms provides historic information to which coastal and riverine flood hazards and the projected flood depths can be compared (References 4 through 8).

October 21-31, 1921

This storm originated in the western Caribbean Sea and on October 25 entered Florida north of Tarpon Springs, where winds were estimated at 70 to 90 knots and tides from 7 to 10 feet above sea level. Its center moved across the Florida peninsula and over the Atlantic coast on October 26. Flooding conditions were prolonged because of the slow forward movement of the storm. Five or six lives were lost and property damage in Florida was placed at $3 million.

June 1934

Excessive rainfall during this period caused flooding in low-lying areas and considerable damage to bridges, highways, and railroad fills in the Withlacoochee River basin in eastern Pasco County.

March 15-18, 1960

Thunderstorms and heavy rainfall averaging more than 10 inches over a 10,000-square-mile area in central Florida resulted in $14 million damage in the Four-Rivers area. In the Withlacoochee River basin in eastern Pasco County, there was damage to residential and agricultural lands and to transportation facilities.

June 4-14, 1966 (Hurricane Alma)

This storm originated from the Gulf of Honduras and passed between Key West and the Dry Tortugas. Tides on the west coast of Florida varied, ranging up to 10 feet above normal. New Port Richey was one of the areas in which the highest tides were reported.

June 19, 1972 (Hurricane Agnes)

Hurricane Agnes originated on the northeastern tip of the Yucatan Peninsula and traveled westward. The storm was of large diameter and, although the center of this storm passed approximately 150 miles west of the Florida peninsula, it produced a high tidal surge. Tides of 3 to 6 feet above normal to the south of the study area (Pinellas County) and 10 feet to the north of the study area (Cedar Key) were reported; some coastal areas experienced erosion from wave action and tidal damage to homes, seawalls, revetments, and roads. Damage from this storm in Pasco County, as elsewhere along the gulf coast of Florida, was minor and was caused mainly by the high winds associated with this storm.

2.4 Flood Protection Measures

No extensive community flood protection projects exist in the tidal areas. Floodproofing of structures is done on an individual basis and includes such measures as elevation of dwellings, conservation of mangrove, and construction of seawalls.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the county, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equalled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance premium rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equalled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual occurrence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported here reflect flooding potentials based on conditions existing in the county at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for floods of the selected recurrence intervals for each stream studied in detail in the county.

The determination of coastal inundation caused by passage of a hurricane storm surge was determined by the joint probability method (Reference 9). The storm populations were described by probability distributions of five parameters which influence surge heights. These were central pressure depression (which measures the intensity of the storm), radius to maximum winds, forward speed of the storm, shoreline crossing point. and crossing angle. These characteristics were described statistically based upon an analysis of observed storms in the vicinity of Pasco County. Primary sources of data for this were the National Climatic Center (Reference 10), Cry (Reference 11), Ho, Schwerdt, and Goodyear (Reference 12), the National Hurricane Research Project (Reference 13), and the Monthly Weather Review (Reference 14). Digitized storm information for all storms from 1886 through 1977 was used to correlate statistics (Reference 15). A summary of the parameters used for the Pasco County area is presented in Table 1.

Pressure Depressions (mb)	85	75	65	55	45	35	25	15	5
Probability Entering	0.02	0.02	0.03	0.04	0.04	0.08	0.26	0.25	0.26
Exiting	0.02	0.02	0.03	0.04	0.05	0.09	0.25	0.25	0.25
Parallel	0.065	0.065	0.09	0.12	0.14	0.13	0.13	0.13	0.13

Storm Radius (nm)	15	30
Probability	0.55	0.45

Forward Speed (knots)	8	14	20
Probability Entering	0.3	0.39	0.31
Exiting	0.68	0.3	0.02
Parallel	0.68	0.3	0.02

	Exiting				Entering
Angular Distributions (degrees)	-90	-45	0	45	90
Probability	0.03	0.18	0.19	0.25	0.35

Angular Rates	1.24×10^{-4}	7.43×10^{-4}	7.85×10^{-4}	1.03×10^{-3}	1.45×10^{-3}

Total Frequency: 4.13×10^{-3} storms/nm-year

TABLE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

PASCO COUNTY, FL
(UNINCORPORATED AREAS)

PARAMETER VALUES FOR SURGE ELEVATION

PASCO COUNTY

For areas subject to flooding directly from the Gulf of Mexico, the Federal Insurance Administration standard coastal surge model was used to simulate the coastal surge generated by any chosen storm (that is, any combination of the five storm parameters defined previously). Performing such simulations for a large number of storms, each of known total probability, permits one to establish the frequency distribution of surge height as a function of coastal location. These distributions incorporate the large-scale surge behavior but do not include an analysis of the added effects associated with much finer scale wave phenomena such as wave height, setup, or runup. As the final step in the calculations, the astronomical tide for the region is statistically combined with the computed storm surge to yield recurrence intervals of total water level. The entire procedure is detailed in the Coastal Flooding Handbook (Reference 16).

The surge model employed in the procedure utilizes a grid pattern approximating the geographical features of the study area and the adjoining areas. Surges were computed utilizing grids of 5 nautical miles.

Surge levels in Anclote and Pithlachascotee Rivers were computed with the aid of a one-dimensional unsteady-flow model. The values for the mouth were taken from the results of the coastal model.

Elevations for floods of the selected recurrence intervals on the Gulf of Mexico are shown in Table 2.

Stream flooding along Anclote and Withlacoochee Rivers was studied using procedures described in U.S. Water Resources Council Guidelines (Reference 18). The flood frequency statistics for Hillsborough River, which runs through the southeastern portion of Pasco County, were developed from stream gage data on the mainstem of Hillsborough River near Zephyrhills and Blackwater Creek (38 years of record). Floodflow frequencies for Hillsborough River were based on standard log-Pearson Type III analyses as outlined by the U.S. Water Resources Council (Reference 18).

The Pithlachascotee River stream gage (No. 2310300) had discharge records from 1963 through 1976, which were not sufficiently long to yield reliable results from flood frequency analysis. The logarithmic mean and standard deviation of the record were adjusted on the basis of regression with nearby long-term records, as recommended in the U.S. Water Resources Council guidelines (Reference 18). The floods of the required frequencies were then computed by performing a log-Pearson Type III analysis.

Duck Slough was studied using procedures described in Technical Report 54 by the U.S. Soil Conservation Service (Reference 19).

Table 2. Summary of Flood Elevations

Flooding Source and Location	Stillwater Flood Elevations* 10-Year	50-Year	100-Year	500-Year
Gulf of Mexico				
At Aripeka	6.9	10.9	12.7	16.5
At Port Richey	6.5	10.3	12.1	15.5
At Bird Key	6.1	9.7	11.4	14.5
Pithlachascotee River				
At Upstream Corporate Limits of New Port Richey	6.2	9.2	10.7	13.6
Anclote River				
At Confluence with Duck Slough	6.0	9.0	10.0	12.5

*In Feet Above NGVD

The Anclote, Pithlachascotee and Withlacoochee River basins, which comprise a large part of the study area, have been altered by the construction of freeways and canals. All major proposed and current projects that affect the study area have been taken into account in this analysis.

Peak discharge-drainage area relationships for Anclote River, Duck Slough, Hillsborough River, Pithlachascotee River, and Withlacoochee River are shown in Table 3.

For areas affected by ponding from Withlacoochee River in the vicinity of Dade City, the hydrology was adopted from flood plain information on Withlacoochee River prepared by Southwest Florida Water Management District (Reference 20). The hydrologic analysis consisted of a hydrologic budget based on the following factors: rainfall, infiltration, ground-water levels, evapotranspiration, basin size, slope, and storm frequency.

Allowance for infiltration to the ground water is assumed to be the wet season capacity. Rainfall frequency data were extracted from U.S. Weather Bureau Technical Paper 40 (Reference 17) for durations up to 24 hours and frequencies up to 100 years. Values for return periods of more than 100 years were estimated by plotting the data from Technical Paper 40 on log-normal probability paper.

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of streams in the county were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along each stream studied in the county.

Water-surface profiles were devloped using the U.S. Army Corps of Engineers HEC-2 computer models (References 21 and 22). Profiles were determined for the 10-, 50-, 100-, and 500-year floods.

Computations for flood levels along the rivers resulting from either coastal surges or rainfall were independently performed. The results of each were combined statistically to obtain flood levels for each return period.

Cross section data for streams studied in detail were obtained by field surveys and from aerial photographs (Reference 23, 24, and 25). Underwater and bridge cross sections were field surveyed. Overbank cross sections were determined using aerial photographs (References 23, 24, and 25).

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway is computed (Section 4.2), selected cross section locations are also shown on the Flood Boundary and Floodway Map (Exhibit 2).

Table 3. Summary of Discharges

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (Cubic Feet per Second) 10-Year	50-Year	100-Year	500-Year
Anclote River					
At State Highway 54	72.5	2,880	5,220	6,420	9,760
Duck Slough					
At Mouth	2.8	109	200	268	415
Hillsborough River					
At Confluence With Blackwater Creek	84	2,600	4,130	4,890	6,800
Pithlachascotee River					
At the City of New Port Richey	182	1,084	2,060	2,600	4,170
Withlacoochee River					
At Trilby	570	3,880	7,260	9,080	14,400

Roughness coefficients (Manning's "n") used in this study were determined from aerial photographs (References 23, 24, and 25) and calibrated using high-water marks. Roughness values ranged from 0.043 to 0.130 in the channels and from 0.070 to 0.300 in the overbank areas.

The starting water-surface elevation for Anclote River was taken from the Flood Insurance Study for the unincorporated areas of Pinellas County (Reference 26). The starting water-surface elevation for Hillsborough River was taken from the Flood Insurance Study for the unincorporated areas of Hillsborough County (Reference 27). Mean high tide was used as the starting water-surface elevation for Pithlachascotee River. The starting water-surface elevation for Duck Slough was determined by normal-depth calculations. The starting water-surface elevation for Withlacoochee River was taken from the flood plain information report prepared by the Southwest Florida Water Management District (Reference 20).

Flood profiles were drawn showing computed water-surface elevations to an accuracy of 0.5 foot for floods of the selected recurrence intervals (Exhibit 1).

For flooding from Withlacoochee River near Dade City, volumetric ponding analysis was utilized to determine the amount and distribution of excess rainfall in the low areas. The ponding depth was based on the volume of water which remained ponded in the low areas after allowances were made for discharge via the pumping system. The analysis indicated the ponding areas have an average ponding depth for the 100-year flood of 1 to 3 feet.

Approximate flood elevations for North Branch Anclote River and South Branch Anclote River upstream of State Highway 54 were taken from flood plain information reports prepared by the Southwest Florida Water Management District (References 28 and 29).

Approximate flood elevations for New River and Hillsborough River, from upstream of State Highway 39 to State Highway 35 were taken from the 1979 flood plain information report prepared by the Southwest Florida Water Management District (Reference 30).

Approximate elevations for Cypress Creek and Pithlachascotee River were taken from reports prepared by the U.S. Geological Survey (References 31 and 32).

Approximate elevations for Bear Creek and Withlacoochee River (from the Old Henley crossing to Cumpressco at State Highway 471) were taken from flood plain information reports prepared by the Southwest Florida Water Management District (References 20 and 33).

Elevations for all other streams studied by approximate methods were developed from normal-depth calculations.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in the study are shown on the maps.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

A prime purpose of the National Flood Insurance Program is to encourage State and local governments to adopt sound flood plain management programs. Each Flood Insurance Study, therefore, includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

4.1 Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by the Federal Insurance Administration as the base flood for purposes of flood plain management measures. The 500-year flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the boundaries of the 100- and 500-year floods have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:24,000, with contour intervals of 5 and 10 feet (Reference 34) and aerial photographs at scales of 1:2,400, 1:4,800, and 1:12,000, with contour intervals of 1 and 2 feet (References 23, 24, and 25).

Pertinent features were verified using county highway maps (Reference 35), nautical charts (Reference 36), and the Real Estate Atlas of Pasco County (Reference 37).

The boundaries of the 100-and 500-year floods due to tidal inundation have been delineated using the flood elevations determined at the coastal surge model grid stations; between grid stations, the boundaries were interpolated using topographic maps and aerial photographs as referenced previously.

The 100-year boundaries for streams studied by approximate methods were delineated using topographic maps (Reference 34) and aerial photographs (References 23, 24, and 25).

Approximate flood boundaries for 22 square miles of lakes and swamps in south-central Pasco County were taken from a study prepared by the Southwest Florida Water Management District (References 38 and 39).

Approximate flood boundaries in some portions of the study area were taken from the Federal Insurance Administration Flood Hazard Boundary Map (Reference 40).

Flood boundaries for the 100-and 500-year floods are shown on the Floodway Boundary and Floodway Map (Exhibit 2). In cases where the 100-and 500-year flood boundaries are close together, only the 100-year flood boundary has been shown. Small areas within the flood boundaries may lie above the flood elevations and, therefore, not be subject to flooding; owing to limitations of the map scale, such areas are not shown.

4.2 Floodways

Encroachment on flood plains, such as artificial fill, reduces the flood-carrying capacity and increases flood heights, thus increasing flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, the concept of a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent flood plain areas, that must be kept free of encroachment in order that the 100-year flood be carried without substantial increases in flood heights. As minimum standards, the Federal Insurance Administration limits such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced.

Floodways are not delineated in coastal high hazard areas. The floodways proposed in this study for riverine areas were computed on the basis of equal-conveyance reduction from each side of the flood plain. Floodway analyses were based on increasing the computed 100-year rainfall flooding level. The results of these computations are tabulated at selected cross sections for each stream segment for which a floodway is computed (Table 4).

As shown on the Flood Boundary and Floodway Map (Exhibit 2), the floodway boundaries were determined at cross sections; between cross sections, the boundaries were interpolated. In cases where the floodway and 100-year flood boundaries are close together, only the floodway boundary has been shown.

The area between the floodway and the boundary of the 100-year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 2.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Anclote River								
A	31,750	2,107[2]	14,202	0.5	9.7[3]	7.5	8.5	1.0
B	38,800	184	2,146	3.2	9.7[3]	8.7	9.6	0.9
C	43,000	1,232	7,688	0.9	10.7[4]	9.9	10.8	0.9
D	46,400	1,377	12,494	0.5	11.0[4]	10.3	11.2	0.9
E	48,750	1,625	12,773	0.5	11.3[4]	10.5	11.4	0.9
F	54,750	980	8,872	0.8	11.7[4]	11.1	12.1	1.0
G	57,350	919	4,923	1.3	12.0[4]	11.6	12.6	1.0
H	61,150	459	4,120	1.6	13.5[4]	13.2	14.2	1.0
I	64,450	361	2,556	2.5	16.9	16.9	17.9	1.0
J	67,200	775	3,424	1.9	19.9	19.9	20.9	1.0
K	70,350	556	4,643	1.4	22.5	22.5	23.5	1.0
L	72,950	275	3,250	2.0	24.0	23.9	24.9	1.0
M	76,750	232	2,125	3.0	28.5	28.5	29.5	1.0
N	81,100	727	7,426	0.9	31.0	31.0	32.0	1.0

[1]Feet Above Mouth [2]Floodway Lies Entirely Outside County Limits [3]Gulf of Mexico Tidal Surge Elevation
[4]Elevation Influenced by Tidal Surge From Gulf of Mexico

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

PASCO COUNTY, FL
(UNINCORPORATED AREAS)

FLOODWAY DATA

ANCLOTE RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Duck Slough								
A	596	42	227	1.2	10.0[2]	2.0	3.0	1.0
B	1,108	39	171	1.6	10.0[2]	2.7	3.7	1.0
C	1,740	35	115	2.3	10.0[2]	5.3	6.2	0.9
D	1,940	50	155	1.7	10.0[2]	6.4	7.1	0.7
E	2,936	61	224	1.2	10.0[2]	8.1	8.9	0.8
F	5,330	39	144	1.9	13.3	13.3	14.3	1.0
G	7,030	91	252	1.1	16.7	16.7	17.6	0.9

[1]Feet Above Mouth [2]Gulf of Mexico Tidal Surge Elevation

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

PASCO COUNTY, FL
(UNINCORPORATED AREAS)

FLOODWAY DATA

DUCK SLOUGH

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						(FEET NGVD)		
Hillsborough River								
A	19,650	964	7,808	0.6	58.4	58.4	59.4	1.0
B	21,250	1,190	10,440	0.5	59.3	59.3	60.3	1.0
C	24,200	1,348	11,272	0.4	60.3	60.3	61.3	1.0
D	25,200	1,613	13,806	0.4	61.0	61.0	62.0	1.0
E	26,000	1,736	15,263	0.3	61.1	61.1	62.1	1.0
F	28,100	1,973	11,207	0.4	61.8	61.8	62.8	1.0
G	30,200	1,145	7,449	0.7	63.3	63.3	64.3	1.0
H	31,700	1,042	7,654	0.6	65.0	65.0	66.0	1.0

[1]Feet Above U.S. Highway 301

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

PASCO COUNTY, FL
(UNINCORPORATED AREAS)

FLOODWAY DATA

HILLSBOROUGH RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Pithlachascotee River								
A	24,390	103	856	3.0	10.7[2]	6.1	7.1	1.0
B	24,950	462	2,501	1.0	10.7[2]	6.4	7.4	1.0
C	28,170	127	747	3.5	10.7[2]	8.6	9.4	0.8
D	28,820	209	1,876	1.4	11.0[3]	9.3	10.1	0.8
E	31,070	237	1,849	1.4	11.5[3]	10.1	10.8	0.7
F	33,262	338	2,331	1.1	12.9[3]	11.5	12.1	0.6
G	34,962	359	2,834	0.9	12.9[3]	12.3	13.0	0.7
H	37,162	270	2,252	1.2	13.9[3]	13.7	14.4	0.7
I	40,942	240	1,618	1.6	16.2	16.2	16.9	0.7
J	43,792	235	2,025	1.3	18.6	18.6	19.4	0.8
K	45,692	453	3,338	0.8	20.5	20.5	21.3	0.8
L	50,672	393	2,009	1.3	23.7	23.7	24.4	0.7

[1]Feet Above U.S. Highway 19 From Gulf of Mexico [2]Gulf of Mexico Tidal Surge Elevation [3]Elevation Influenced by Tidal Surge

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

PASCO COUNTY, FL
(UNINCORPORATED AREAS)

FLOODWAY DATA

19

PITHLACHASCOTEE RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Withlacoochee River								
A	1,100	823	9,485	1.0	67.4	67.4	68.4	1.0
B	2,400	413	5,958	1.5	68.0	68.0	69.0	1.0
C	3,450	610	8,251	1.1	69.1	69.1	70.0	0.9
D	5,800	1887/985[2]	26,634	0.3	69.9	69.9	70.8	0.9
E	9,850	1023/100[2]	11,453	0.8	70.4	70.4	71.3	0.9
F	12,477	1236/160[2]	16,136	0.6	71.0	71.0	71.9	0.9
G	15,050	1180/795[2]	16,330	0.6	71.1	71.1	72.0	0.9
H	21,664	1,414	7,672	1.2	72.3	72.3	73.2	0.9

[1]Feet From County Limits [2]Width/Width Within Pasco County Limits

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

PASCO COUNTY, FL
(UNINCORPORATED AREAS)

FLOODWAY DATA

WITHLACOOCHEE RIVER

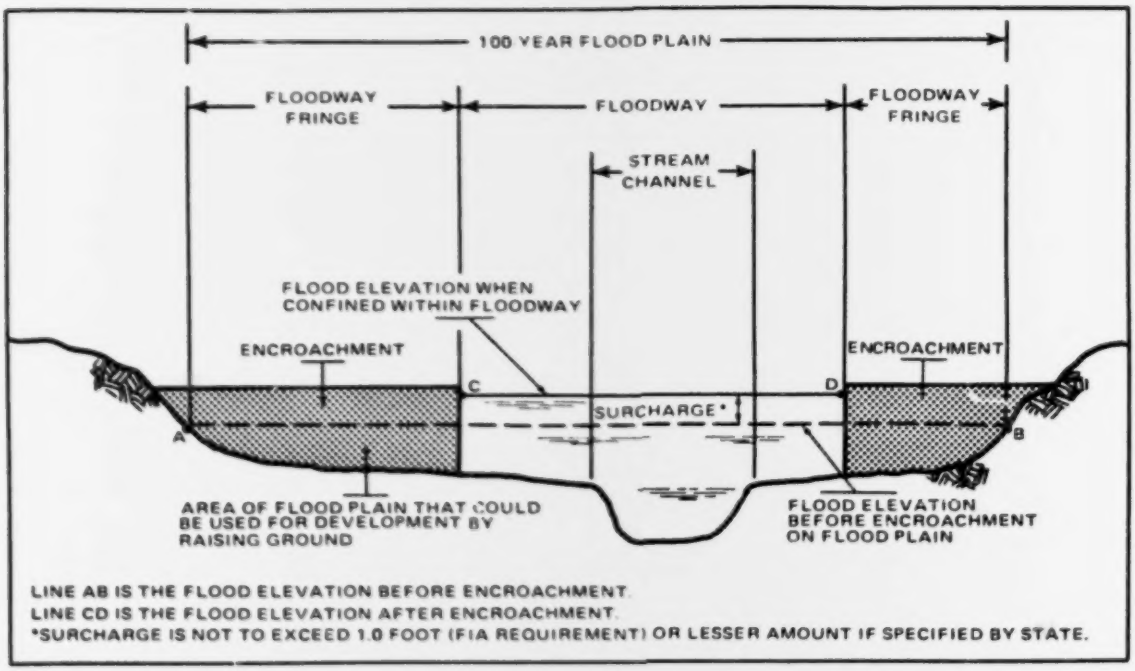
100 YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE AB IS THE FLOOD ELEVATION BEFORE ENCROACHMENT.
LINE CD IS THE FLOOD ELEVATION AFTER ENCROACHMENT.
*SURCHARGE IS NOT TO EXCEED 1.0 FOOT (FIA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE.

Figure 2. Floodway Schematic

5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, the Federal Insurance Administration has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors, and flood insurance zone designations for each flooding source studied in detail affecting Pasco County.

5.1 Reach Determinations

Reaches are defined as lengths of watercourses having relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference does not have a variation greater than that indicated in the following table for more than 20 percent of the reach:

Average Difference Between 10- and 100-Year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

The locations of the reaches determined for the flooding sources of Pasco County are shown on the Flood Profiles (Exhibit 1) and summarized in Table 5.

5.2 Flood Hazard Factors

The Flood Hazard Factor (FHF) is the Federal Insurance Administration device used to correlate flood information with insurance rate tables. Correlations between property damage from floods and their FHF are used to set actuarial insurance premium rate tables based on FHFs from 005 to 200.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations expressed to the nearest one-half foot, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year water-surface elevations is greater than 10.0 feet, accuracy for the FHF is to the nearest foot.

5.3 Flood Insurance Zones

After the determination of reaches and their respective Flood Hazard Factors, the entire unincorporated area of Pasco County was divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations:

Zone A:	Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations shown or Flood Hazard Factors determined.
Zone AH:	Special Flood Hazard Areas inundated by types of 100-year shallow flooding where depths are between 1.0 and 3.0 feet; base flood elevations are shown, but no FHFs are determined.
Zones A2, A4, A6, A7, A8, A9, A11, and A12:	Special Flood Hazard Areas inundated by the 100-year flood, determined by detailed methods; base flood elevations shown, and zones subdivided according to Flood Hazard Factors.
Zones V11 and V12:	Special Flood Hazard Areas along coasts inundated by the 100-year flood, as determined by detailed methods, and that have additional hazards due to velocity (wave action); base flood elevations shown, and zones subdivided according to Flood Hazard Factors.

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION (FEET NGVD)[3]
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
Gulf of Mexico							
Reach 1	0345,0180, 0188,0189, 0335,0351, 0353	-5.6	-1.7	3.4	055	V11, A11	11, 12
Reach 2	0180,0185, 0015,0020	-5.8	-2.0	3.8	060	V12, A12	13
Reach 3	0352	-4.5	-1.5	3.0	045	A9	11
Anclote River							
Reach 1	0361,0362	-4.0	-1.0	2.0	040	A8	Varies - See Map
Reach 2	0354,0360	-3.2	-0.9	1.7	030	A6	Varies - See Map
Duck Slough							
Reach 1	0362	-1.0	-0.4	0.6	010	A2	Varies - See Map
Hillsborough River							
Reach 1	0455,0460 0465,0470	-2.0	-0.7	1.5	020	A4	Varies - See Map
Pithlachascotee River							
Reach 1	0195,0352 0360	-3.4	-2.2	2.2	035	A7	Varies - See Map
Withlacoochee River							
Reach 1	0102,0106, 0107	-4.5	-1.3	3.3	045	A9	Varies - See Map
Ponding	0280,0285	N/A	N/A	N/A	N/A	AH	78

[1]Flood Insurance Rate Map Panel [2]Weighted Average [3]Rounded to Nearest Foot

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

PASCO COUNTY, FL
(UNINCORPORATED AREAS)

FLOOD INSURANCE ZONE DATA

GULF OF MEXICO-ANCLOTE RIVER-DUCK SLOUGH-HILLSBOROUGH RIVER-PITHLACHASCOTEE RIVER-WITHLACOOCHEE RIVER

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100 YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION[3] (FEET NGVD)
		10% (10 YEAR)	2% (50 YEAR)	0.2% (500 YEAR)			
CYPRESS CREEK							
REACH 1	0425	-2.2	-0.6	1.3	020	A4	52
REACH 2	0425	-3.2	-0.9	2.0	030	A6	57
REACH 3	0425	-2.6	-1.0	2.0	025	A5	57
REACH 4	0250,0425	-0.9	-0.2	1.2	010	A2	VARIES – SEE MAP
REACH 5	0250	-1.7	-0.4	0.5	015	A3	65
REACH 6	0250	-1.0	-0.2	0.5	010	A2	VARIES – SEE MAP
TROUT CREEK							
REACH 1	0425,0450	-2.2	-0.7	1.4	020	A4	VARIES – SEE MAP
REACH 2	0425	-1.6	-0.6	1.8	015	A3	VARIES – SEE MAP
REACH 3	0425	-2.3	-0.6	1.5	025	A5	57

[1]FLOOD INSURANCE RATE MAP PANEL
[2]WEIGHTED AVERAGE
[3]ROUNDED TO NEAREST FOOT

REVISED: 2/17/89

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

PASCO COUNTY, FL
(UNINCORPORATED AREAS)

FLOOD INSURANCE ZONE DATA

CYPRESS CREEK–TROUT CREEK

Zone B:	Areas between the Special Flood Hazard Areas and the limits of the 500-year flood, including areas of the 500-year flood plain that are protected from the 100-year flood by dike, levee, or other water control structure; also areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.
Zone C:	Areas of minimal flooding.

The flood elevation differences, Flood Hazard Factors, flood insurance zones, and base flood elevations for each flooding source studied in detail in the county are summarized in Table 5.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for Pasco County is, for insurance purposes, the principal result of the Flood Insurance Study. This map (published separately) contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. This map is developed in accordance with the latest flood insurance map preparation guidelines published by the Federal Insurance Administration.

6.0 OTHER STUDIES

The Federal Insurance Administration has previously published a Flood Hazard Boundary Map for the unincorporated areas of Pasco County; however, this study employs a more detailed analysis in some areas of the county and, therefore, supersedes the previous study (Reference 40).

There are flood-related studies which concentrate on portions of the study area. Approximate flood elevations for Anclote River, Hillsborough River, Withlacoochee River, and Bear Creek were taken from flood plain information reports prepared by the Southwest Florida Water Management District (References 28 through 30, 20, and 33). Approximate flood elevations for Cypress Creek and Pithlachascotee River were taken from reports prepared by the U.S. Geological Survey (References 31 and 32).

The 100-year flood elevations for the gulf coast of Florida were published by the National Oceanic and Atmospheric Administration in 1975 (Reference 4). The report predicted a 100-year flood level of approximately 13 to 12 feet south to north in this region as compared to 11 to 13

feet south to north predicted by the analysis of this study. This difference is the result of differences in the manner in which shoreline configuration and bathymetry are included within the hydrodynamic models; in particular, the present study included the whole of Tampa Bay as an integral part of the hydrodyamic analysis.

Flood Insurance Studies have been prepared for Pinellas County, Hillsborough County, the Cities of Port Richey, New Port Richey, Dade City, and Tarpon Springs, Florida (References 26, 27, and 41 through 44, respectively). Flood boundaries and elevations in these reports are in agreement with this study. Zone designations along Cypress Creek differ between Hillsborough County and Pasco County. Due to different scopes of study, Cypress Creek, determined by approximate methods in Pasco County, was studied by detailed methods in Hillsborough County. However, flood boundaries between these two studies, are in agreement.

This study is authoritative for the purposes of the National Flood Insurance Program; data presented herein either supersede or are compatible with all previous determinations.

7.0 LOCATION OF DATA

Survey, hydrologic, hydraulic, and other pertinent data used in this study can be obtained by contacting the Insurance and Mitigation Division, Federal Emergency Management Agency, 1375 Peachtree Street, NE., Atlanta, Georgia 30309.

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9.0 WAVE HEIGHT ANALYSIS REVISION (September 15, 1983)

This section has been added to incorporate the September 15, 1983, Flood Insurance Study supplement titled "Wave Height Analysis" into the current Flood Insurance Study report.

9.1 Introduction

The Federal Emergency Management Agency (FEMA) recently adopted recommendations by the National Academy of Sciences to include predictions of wave heights in Flood Insurance Studies for coastal communities subject to storm surge flooding, and to report the estimated wave crest elevations as base flood elevations on Flood Insurance Rate Maps (FIRMs).

Previously, FIRMs were produced showing only the stillwater storm-surge elevations, due to the lack of a suitable and generally applicable methodology for estimating the wave crest elevations associated with storm surges. These stillwater elevations were subsequently stipulated in community flood plain management ordinances as the minimum elevation of the first floor of new construction. Communities and individuals had to consider the additional hazards of velocity waters and wave action on an ad hoc basis. Because there has been a pronounced tendency for buildings to be constructed to meet only minimum standards without consideration of the additional hazard due to wave height, increasing numbers of people could unknowingly be accepting a high degree of flood-related personal and property risk in coastal areas subject to wave action. Therefore, FEMA has pursued the development of a suitable methodology for estimating the wave crest elevations associated with storm surges. The recent development of such a methodology by the National Academy of Sciences (Reference 45) has led to the adoption of wave crest elevations for use as the base flood elevations in coastal communities.

Pasco County, Florida, is located on the Gulf of Mexico and is subject to flooding from tidal surges associated with hurricanes.

Several hurricanes have occurred in and around Pasco County. Among the more severe were the storms of October 1921, August-September 1935, and September 1950. During the storm of October 1921, estimated wind speeds of 80 to 100 miles per hour were reported in the area; tides reached elevations of 7 to 10 feet. The August-September 1935 storm was one of the most severe tropical disturbances ever recorded, and caused severe damage along many of the beach areas in the central and upper portions of the gulf coast. The small, severe storm of September 1950, Hurricane Easy, also caused heavy damage along beach areas in the central and upper portions of the gulf coast.

The purpose of this study is to revise the FIRM for Pasco County to include the effects of wave action associated with flooding from the Gulf of Mexico at the open coast.

9.2 Investigations

a. Previous Studies

Stillwater elevations for hurricane surges with 10-, 50-, 100-, and 500-year return periods were determined by Tetra Tech, Inc., for the Gulf of Mexico at the open coast. The 100-year stillwater elevations were used as the base flood elevations for the original study and for the FIRM that is now in effect for Pasco County (References 46 and 47).

The storm-surge elevations were determined using the joint probability method (Reference 48). The storm populations were described by probability distributions of five parameters that influence surge heights: central pressure depression (which measures the intensity of the storm), radius to maximum winds, forward speed, shoreline crossing point, and crossing angle. These parameters were described statistically, based on an analysis of observed storms in the vicinity of Pasco County. Primary sources of data for this analysis were the National Climatic Center (Reference 49), the U.S. Weather Bureau (Reference 50), the National Weather Service (Reference 51), the National Hurricane Research Project (Reference 52), and the Monthly Weather Review (Reference 53). Digitized storm information for all storms from 1886 through 1977 was used to correlate statistics (Reference 54).

For portions of the Pithlachascotee River, the Anclote River, and Duck Slough, flood levels resulting from coastal flooding and from rainfall were determined independently of each other and combined statistically.

The stillwater storm-surge elevations developed for the previous study (Reference 46) were used for the wave height analysis presented herein.

Elevations for floods of selected recurrence intervals on the Gulf of Mexico, the Pithlachascotee River, and the Anclote River are shown in Table 2.

This report is authoritative for purposes of the National Flood Insurance Program. Data presented herein supersede all previous flood elevation determinations.

b. Data Collection and Review

All available source data applicable for the wave height analysis were collected and reviewed. Because wave height calculations are based on parameters such as the size and density of vegetation, natural barriers (such as sand dunes), buildings, and other manmade structures, it was necessary to obtain detailed information on the physical and cultural features of the study area.

The principal source materials used for the wave height analysis were U.S. Geological Survey topographic maps at a scale of 1:24000, with contour intervals of 5 and 10 feet (Reference 55); aerial photographs at scales of 1:10800 and 1:21600, developed by Real Estate Data, Inc. (Reference 56); and aerial photographs at scales of 1:2400 and 1:4800, with contour intervals of 1 and 2 feet, developed by the Southwest Florida Water Management District (Reference 57).

c. Wave Height Analysis

The methodology for analyzing the effects of wave heights associated with coastal storm surge flooding is described in the National Academy of Sciences report (Reference 45). This method is based on the following major concepts. First, depth-limited waves in shallow water reach a maximum breaking height that is equal to 0.78 times the stillwater depth. The wave crest is 70 percent of the total wave height above the stillwater level. The second major concept is that wave height may be diminished by dissipation of energy due to the presence of obstructions such as sand dunes, dikes and seawalls, buildings, and vegetation. The amount of energy dissipation is a function of the physical characteristics of the obstruction and is determined by procedures prescribed in the National Academy of Sciences report. The third major concept is that wave height can be regenerated in open fetch areas due to the transfer of wind energy to the water. This added energy is related to fetch length and depth.

Wave heights were computed along transects (cross section lines) in accordance with the Users Manual for Wave Height Analysis (Reference 58). The transects were located along the coastline as shown in Figure 3. They were located with consideration given to the physical and cultural characteristics of the land so that they would closely represent conditions in their locality. Transects were spaced close together in areas of complex topography and dense development. In areas having more uniform characteristics, they were spaced at larger intervals. It was also necessary to locate transects in areas where unique flooding existed and in areas where computed wave heights varied significantly between adjacent transects.

Each transect was taken perpendicular to the shoreline and extended to the inland limit of tidal flooding. Along each transect, wave heights and elevations were computed considering the combined effects of changes in ground elevation, vegetation, and physical features. The stillwater elevations for the 100-year flood were used for these computations. Wave heights were calculated to the nearest 0.1 foot, and wave elevations were determined at whole-foot increments along the transects. The location of the 3-foot breaking wave for determining the terminus of the V Zone (area with velocity wave action) was also computed at each transect.

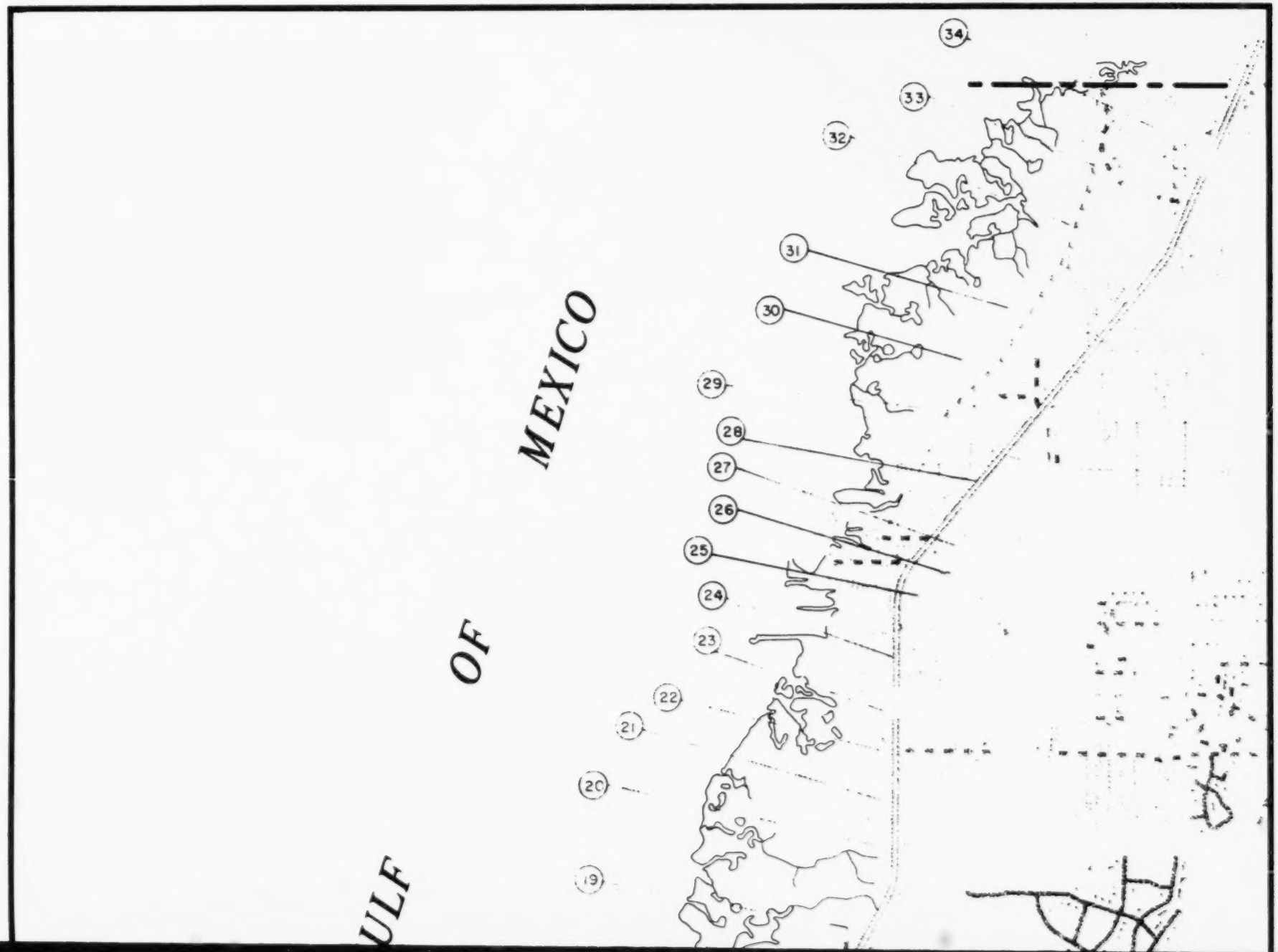
GULF
OF
MEXICO
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FIGURE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

PASCO COUNTY, FL
(UNINCORPORATED AREAS)

APPROXIMATE SCALE

1.25 0 1.25 2.50 3.75 MILES

TRANSECT LOCATION MAP

Figure 4 is a profile for a typical transect illustrating the effects of energy dissipation and regeneration on a wave as it moves inland. This figure shows the wave elevations being decreased by obstructions, such as buildings, vegetation, and rising ground elevations, and being increased by open, unobstructed wind fetches. Actual wave conditions in Pasco County may not necessarily include all the situations illustrated in Figure 4.

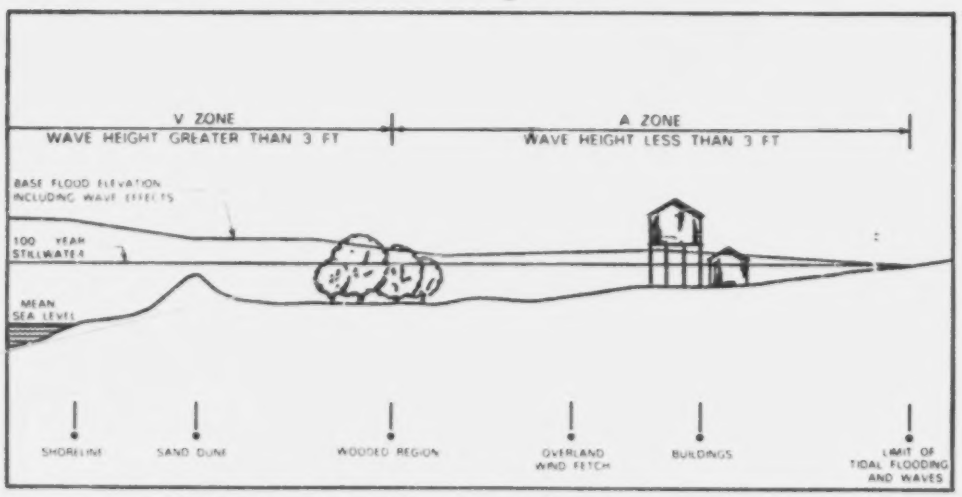

FIGURE 4 - Typical Transect Schematic

After analyzing wave heights along each transect, wave elevations were interpolated between transects. Various source data were used in the interpolation, including topographic maps (References 55 and 57) and aerial photographs (Reference 56), as well as engineering judgment. Controlling features affecting the elevations were identified and considered in relation to their positions at a particular transect and their variation between transects.

d. Results

During a 100-year storm tide in Pasco County, waves ranging from 9 feet in height at the southern end of the county to 10 feet at the northern end will be encountered at the Gulf of Mexico shoreline. No waves will be generated on Pithlachascotee River, Anclote River, or Duck Slough due to insufficient fetch lengths.

North of Cedar Island on the Gulf of Mexico, a maximum wave crest elevation of 20 feet will occur at the shoreline. Waves higher than 3 feet will propagate approximately 3,500 to 5,000 feet inland before being dissipated by sparse vegetation. Between Cedar Island and The Union, the maximum wave crest elevation at the shoreline is 19 feet, and south of The Union to the county limits, 18 feet. In the vicinity of Hudson, between Sterling Lane and Clarita Drive, waves greater than 3 feet will penetrate approximately 1,000 feet inland before being dissipated by obstructions, such as buildings and vegetation, and by rising ground elevation. Between Hudson and Port Richey, waves

higher than 3 feet will extend 5,000 to 6,000 feet inland through sparse vegetation. South of Port Richey to the southern county limits, waves greater than 3 feet penetrate only 400 to 500 feet inland due to the denser vegetation found near the shoreline. Waves of 1 to 2 feet in height will continue inland varying distances before being completely dissipated by obstructions, such as vegetation and buildings, and rising ground elevation.

Seawalls and bulkheads have been constructed along portions of the shoreline at Hudson and at Gulf Harbors. These structures were considered to remain intact during a 100-year storm tide. While these structures are effective in dissipating the higher waves by depth-limitation, they are of insufficient height to completely dissipate incoming waves due to the depth of flooding.

9.3 Flood Plain Management Applications

A prime purpose of the National Flood Insurance Program is to encourage local governments to adopt sound flood plain management programs designed to reduce future flood losses. The FIRM for Pasco County has been revised to incorporate the latest available information, including wave height data, to assist the community in developing the most appropriate and effective flood plain management measures.

a. Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by FEMA as the base flood for purposes of flood plain management. This flood has a 1 percent chance of being equalled or exceeded each year and is expected to be exceeded once on the average during any 100-year period. The risk of having a flood of this magnitude or greater increases when periods longer than 1 year are considered. For example, over a 30-year period, there is a 26 percent chance of experiencing a flood equal to or greater than the 100-year flood. The 500-year flood plain is also shown on the FIRM to indicate areas of moderate flood hazards.

Areas inundated by the 100-year flood are shown as Zones A and V on the community's FIRM. It is in these areas that FEMA requires local communities to exercise floodplain management measures as a condition for participation in the National Flood Insurance Program.

b. Base Flood Elevations

Areas within the community studied by detailed engineering methods have base flood elevations established in Zones A and V. These are the elevations of the base (100-year) flood relative to the National Geodetic Vertical Datum of 1929. In coastal areas affected by wave action, base flood elevations are generally highest at the open coast shoreline. Moving inland, these elevations generally decrease at a rate dependent on the presence of obstructions capable of dissipating

the wave energy. Where possible, changes in base flood elevations have been shown in one-foot increments on the FIRM. However, where the scale did not permit, 2- or 3-foot increments were sometimes used. Base flood elevations shown in the wave action areas represent the average elevation within the zone. Current program regulations generally require that all new construction be elevated such that the first floor, including basement, is above the base flood elevation in A and V Zones.

c. Velocity Zones

The U.S. Army Corps of Engineers (Reference 59) has established the 3-foot breaking wave as the criterion for identifying coastal high hazard zones. This was based on a study of wave action effects on structures. This criterion has been adopted by FEMA for the determination of V zones. Because of the additional hazards associated with high-energy waves, the National Flood Insurance Program regulations require much more stringent flood plain management measures in these areas, such as elevating structures on piles or piers. In addition, insurance rates in V zones are higher than those in A zones with similar numerical designations.

The location of the V Zone is determined by the 3-foot breaking wave as discussed previously. The detailed analysis of wave heights performed in this study allowed a much more accurate location of the V Zone to be established. The V Zone generally extends inland to the point where the 100-year flood depth is insufficient to support a 3-foot breaking wave.

9.4 Insurance Applications

The assignment of proper actuarial insurance rates requires that frequency and depth of flooding be estimated as accurately as possible. Because waves can add considerably to expected flood depths, it is important that insurance rates consider this additional hazard. FEMA has developed a process to transform the data from this study into flood insurance criteria. This process includes the determination of Flood Hazard Factors (FHFs) and the designation of flood insurance zones.

a. Flood Hazard Factors

The FHF is the device used to correlate flood information with insurance rate tables. Correlations between property damage from floods and their FHF are used to set actuarial insurance premium rate tables.

The FHF is shown as a three-digit code that expresses the difference between the 10- and 100-year flood elevations to the nearest 0.5 foot. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year water-

surface elevations is greater than 10.0 feet, the FHF is computed to the nearest foot.

b. Flood Insurance Zones

After wave elevations for the 100-year storm surge were determined and mapped, the study areas were divided into zones, each having a specific flood potential and FHF. Each zone was assigned one of the following flood insurance zone designations:

Zones V16-V18

Special Flood Hazard Areas inundated by the 100-year flood, and that have additional hazards due to velocity (wave action); base flood elevations shown, and zones subdivided according to FHFs.

Zones A6-A9, A13, and A14

Special Flood Hazard Areas inundated by the 100-year flood, with base flood elevations determined and zone designations assigned according to the FHFs.

Zone B

Areas between the Special Flood Hazard Areas and the limits of the 500-year flood plain, including areas that are protected from the 100- and 500-year floods by dike, levee, or other water control structure; and areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot, or where the contributing drainage area is less than 1 square mile. Zone B is not subdivided.

Zone C

Areas not subject to flooding by the 500-year flood. Zone C is not subdivided.

Table 6, "Coastal Flood Insurance Zone Data," summarizes the FHFs, flood insurance zones, and base flood elevations for each flooding source in the study area.

c. Flood Insurance Rate Map

After flood insurance zones were established for the study area, the Flood Insurance Rate Map for Pasco County was revised to incorporate the new zone information. In addition, zone boundaries were revised in some areas based on updated topographic information (References 60 and 61). The FIRM contains the official delineation of flood insurance zones and base flood elevations.

In preparing the revised FIRM, 100-year flood elevations for the Withlacoochee River upstream of State Highway 575, North and South Branch Anclote River, the Anclote River upstream of State Highway

FLOODING SOURCE	TRANSECT	PANEL[1]	ELEVATION DIFFERENCE[2,3] BETWEEN 1.0% (100 YEAR) FLOOD AND 10% (10 YEAR)	FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION[3,4] (FEET NGVD)
GULF OF MEXICO						
OPEN COAST, FROM HAMMOCK POINT AT NORTHERN COUNTY LIMITS TO CEDAR ISLAND, EAST TO VICINITY OF U.S. HIGHWAY 19	29–34	0015,0020	5.8	090 070	V18 A14	15 - 20 13 - 15
OPEN COAST, FROM CEDAR ISLAND, SOUTH TO THE UNION, EAST TO VICINITY OF U.S. HIGHWAY 19	2–28	0015,0020,0180, 0186,0187,0188, 0335,0351,0353	5.6	085 065	V17 A13	14 - 19 12 - 14
OPEN COAST, FROM THE UNION SOUTH TO BIRD KEY AT THE SOUTHERN COUNTY LIMITS, EAST TO VICINITY OF STATE HIGHWAY 595 (ALTERNATE)	1	0354,0361	5.3	080 065	V16 A13	14 - 18 11 - 13
PITHLACHASCOTEE RIVER						
FROM PORT RICHEY TO MICHIGAN AVENUE	N/A	0188,0351	6.3	065	A13	12
FROM MICHIGAN AVENUE TO APPROXIMATELY 1 MILE UPSTREAM OF NEW PORT RICHEY	N/A	0351,0352	4.7	045	A9	11

[1]FLOOD INSURANCE RATE MAP PANEL
[2]WEIGHTED AVERAGE IN FEET
[3]ROUNDED TO NEAREST FOOT
[4]DUE TO MAP SCALE LIMITATIONS, BASE FLOOD ELEVATIONS SHOWN ON MAP MAY REPRESENT AVERAGE ELEVATIONS FOR THE ZONES DEPICTED

REVISED: 9/15/83

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

PASCO COUNTY, FL
(UNINCORPORATED AREAS)

COASTAL FLOOD INSURANCE DATA

GULF OF MEXICO–PITHLACHASCOTEE RIVER

FLOODING SOURCE	TRANSECT	PANEL[1]	ELEVATION DIFFERENCE[2,4] BETWEEN 1.0% (100 YEAR) FLOOD AND 10% (10 YEAR)	FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION[3,4] (FEET NGVD)
PITHLACHASCOTEE RIVER (CONT'D)						
FROM APPROXIMATELY 1 MILE UPSTREAM OF NEW PORT RICHEY TO APPROXIMATELY 9,300 FEET UPSTREAM OF ROWAN ROAD	N/A	0352,0360	3.7	035	A7	VARIES – SEE MAP
ANCLOTE RIVER						
FROM SOUTHERN COUNTY LIMITS TO 3,500 FEET DOWNSTREAM OF PERRINE RANCH ROAD	N/A	0361,0362	4.1	040	A8	VARIES -- SEE MAP
FROM 3,500 FEET DOWNSTREAM OF PERRINE RANCH ROAD TO 3,500 FEET DOWNSTREAM OF CEDAR BOULEVARD	N/A	0353,0354,0361, 0362	3.2	030	A6	VARIES – SEE MAP
DUCK SLOUGH						
FROM CONFLUENCE WITH ANCLOTE RIVER TO 3,800 FEET UPSTREAM	N/A	0362	3.8	040	A8	10

[1]FLOOD INSURANCE RATE MAP PANEL
[2]WEIGHTED AVERAGE IN FEET
[3]ROUNDED TO NEAREST FOOT
[4]DUE TO MAP SCALE LIMITATIONS, BASE FLOOD ELEVATIONS SHOWN ON MAP MAY REPRESENT AVERAGE ELEVATIONS FOR THE ZONES DEPICTED

REVISED 9/15/83

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

PASCO COUNTY, FL
(UNINCORPORATED AREAS)

COASTAL FLOOD INSURANCE DATA

PITHLACHASCOTEE RIVER—ANCLOTE RIVER—DUCK SLOUGH

54, Bear Creek, New River, and Hillsborough River upstream of State Highway 39 were incorporated from reports prepared by the Southwest Florida Water Management District (References 62-66). The 100-year flood elevations for Cypress Creek and the Pithlachascotee River upstream of De Cubell Drive were incorporated from reports prepared by the U.S. Geological Survey (References 67 and 68). Elevations contained in the reports were used to delineate the 100-year boundary using detailed topographic maps (References 60, 61, and 69-76).

9.5 Other Studies

Flood Insurance Studies for the Cities of Port Richey and New Port Richey are being revised concurrently with the Pasco County study. The revised studies will be in agreement with this study.

9.6 References

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46. Federal Emergency Management Agency, Flood Insurance Study, Pasco County, Unincorporated Areas, Florida, December 1980.

47. ————, Flood Insurance Rate Map, Pasco County, Unincorporated Areas, Florida, June 1981.

48. U.S. Department of Commerce, Environmental Science Services Administration, Technical Memorandum WBTM Hydro 11, Joint Probability Method of Tide Frequency Analysis, V.A. Myers, April 1970.

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52. ————, National Hurricane Research Project, Report No. 5, Survey of Meteorological Factors Pertinent to Reduction of Loss of Life and Property in Hurricane Situations, March 1957.

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54. ————, National Oceanic and Atmospheric Administration, National Weather Service, Tape of Digitized Storm Information from 1886 through 1977, Asheville, North Carolina.

55. U.S. Department of the Interior, Geological Survey, 7.5-Minute Series Topographic Maps, Scale 1:24,000, Contour Intervals 5 and 10 feet: Dade City, Florida, (1960); Lacoochee, Florida, (1960); Wesley Chapel, Florida, (1973); Lutz, Florida, (1974); San Antonio, Florida, (1954); Branchborough, Florida, (1960); Zephyrhills, Florida, (1975); Elfers, Florida, (1974); Masaryktown, Florida, (1954); Odessa, Florida, (1974); Fivay Junction, Florida, (1954); Spring Lake, Florida, (1954); Socrum, Florida, (1975); Port Richey, Florida, (1954); Ehren, Florida, (1954); Clay Sink, Florida, (1960); Port Richey NE, Florida, (1954); Aripeka, Florida, (1954); Tarpon Springs, Florida, (1973).

56. Real Estate Data, Inc., Real Estate Atlas of Pasco County, Florida, Scales 1:21,600 and 1:10,800, 1976 and 1979.

57. Southwest Florida Water Management District, Aerial Photography with Contours, Scales 1:2,400 and 1:4,800, Contour Intervals 1 and 2 feet, 1971.

58. Federal Emergency Management Agency, Users Manual for Wave Height Analysis, Revised February 1981.

59. U.S. Department of the Army, Corps of Engineers, Galveston District, Guidelines for Identifying Coastal High Hazard Zones, June 1975.

60. Southwest Florida Water Management District, Aerial Photography With Contours, Pithlachascotee River Basin, Scale 1:12,000, Contour Interval 2 Feet: Aripeka Area, Sheet Number Mosaic 2 (1975); Buckhorn Creek, Sheet Number 1, (1980); Pithlachascotee River, Sheet Number 1, (1974).

61. ————, Aerial Photography With Contours, Pithlachascotee River Basin, Phase II-A, Scale 1:4,800, Contour Interval 2 feet: Sheet Numbers 1-18, (1971).

62. ————, Flood Plain Information on the Withlacoochee River from Nobleton at S.R. 476 to Cumpressco at S.R. 471, Sumter, Hernando, and Pasco Counties, Florida, October 1976.

63. ————, Flood Plain Information on the Anclote River From Mouth to South Branch Anclote River at S.R. 54, Pasco and Pinellas Counties, Florida, April 1976.

64. ----------, Pinellas-Anclote River Basin Board, Flood Plain Information on North Branch Anclote River From the Mouth to Section 33, Pasco County, Florida, July 1977.

65. ————, Flood Plain Information on Bear Creek From Beacon Woods to S.R. 587, 1979.

66. ----------, Flood Plain Information on the Hillsborough River Watershed, Hillsborough River and New River, 1979.

67. U.S. Department of the Interior, Geological Survey, Flood Profiles for Cypress Creek, West Central Florida, W.R. Murphy, Jr., and Southwest Florida Water Management District, April 1978.

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70. ————, Aerial Photography With Contours, Withlacoochee River Basin, Scale 1:2,400, Contour Interval 1 foot: Dade City, 1977.

71. ————, Aerial Photography With Contours, Green Swamp Basin, Scale 1:12000, Contour Interval 2 Feet: Upper Hillsborough FDA, (1975).

72. ————, Aerial Photography With Contours, Pithlachascotee River Basin, Scale 1:12000, Contour Interval 2 Feet: Pithlachascotee River, Sheets 1-4, (1974).

73. ————, Aerial Photography With Contours, Scale 1:4800, Contour Intervals 1 and 2 Feet: North Branch Anclote River, (1971); Pinellas -Anclote Basin, (1971).

74. ————, Aerial Photography With Contours, Green Swamp Basin, Scale 1:2400, Contour Interval 1 Foot: Upper Hillsborough FDA, (1975).

75. ————, Aerial Photography With Contours, Hillsborough River Basin, Scale 1:12000, Contour Interval 2 Feet: Big Cypress Swamp, Cypress Creek, (1972).

76. ————, Aerial Photography With Contours, Hillsborough River Basin, Scale 1:2400, Contour Interval 1 Foot: Big Cypress Swamp, Cypress Creek, (1977).

10.0 REVISIONS DESCRIPTION

This section has been added to provide information regarding significant revisions made since the original Flood Insurance Study was printed. Future revisions may be made that do not result in the republishing of the Flood Insurance Study report. To assure that any user is aware of all revisions, it is advisable to

contact the community repository of flood hazard data located at 7530 Little Road, New Port Richey, Florida.

10.1 First Revision (Revised February 17, 1989)

a. Acknowledgments

The hydrologic and hydraulic analyses for this Revisions Description were performed by the Southwest Florida Water Management District (SWFWMD). The Federal Emergency Management Agency reviewed and accepted these data for purposes of this revision.

b. Scope

Detailed methods were used to study Cypress Creek and Trout Creek. Flood boundaries along the entire reaches of both creeks were revised. The stream lines for both creeks were also revised.

c. Hydrologic and Hydraulic Analyses

The methods used for the hydrologic and hydraulic analyses for Trout and Cypress Creeks are discussed in the SWFWMD Floodplain Information Reports on Trout Creek and Cypress Creek (References 77 and 78). The discharges for Trout Creek were calculated using data collected from the U.S. Geological Survey (USGS) gaging station at the State Road 581 and Trout Creek crossing. The discharges for Cypress Creek were developed using the USGS report titled "Techniques for Estimating Magnitude and Frequency of Floods in Natural-Flow Streams in Florida" (Reference 79). The revised discharges for Trout and Cypress Creeks are listed in Table 7.

The hydraulic analyses for both creeks were performed by the SWFWMD using the USGS E431 computer program (Reference 80). The flood boundaries were redelineated by the SWFWMD, using aerial topographic maps (Reference 81).

d. Other Studies

The Flood Insurance Study for Hillsborough County, Florida (Reference 82) is being revised in conjunction with this revision and is in agreement with this study.

TABLE 7 - REVISED SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQ MILES)	PEAK DISCHARGE (CFS) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
TROUT CREEK					
just downstream of Interstate 75	6*	278	595	779	1,316
at downstream county boundary	22*	857	1,842	2,399	4,053

TABLE 7 - REVISED SUMMARY OF DISCHARGES (Continued)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQ MILES)	PEAK DISCHARGE (CFS) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
CYPRESS CREEK					
just downstream of Ten Cent Road	72	911	1,607	1,977	2,857
just downstream of Interstate 75	117	1,512	2,598	3,209	4,776

*Approximate. Does not include drainage area upstream of the divergence with Cypress Creek.

e. References and Bibliography

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80. U.S. Department of the Interior, Geological Survey, Open-File Report, Computer Program E431, Users Manual, Computer Applications for Step-Backwater and Floodway Analyses, James O. Shearman, Washington, D.C., 1976.

81. Southwest Florida Water Management District, Aerial Photography with Contours, Scale 1:12000, Contour Interval 2 Feet: Cypress Creek, 1973; Pithlachascotee River Basin, 1974; and Upper Hillsborough River, 1975.

82. Federal Emergency Management Agency, Flood Insurance Study, Hillsborough County, Unincorporated Areas, Florida, January 1987, revision in progress.

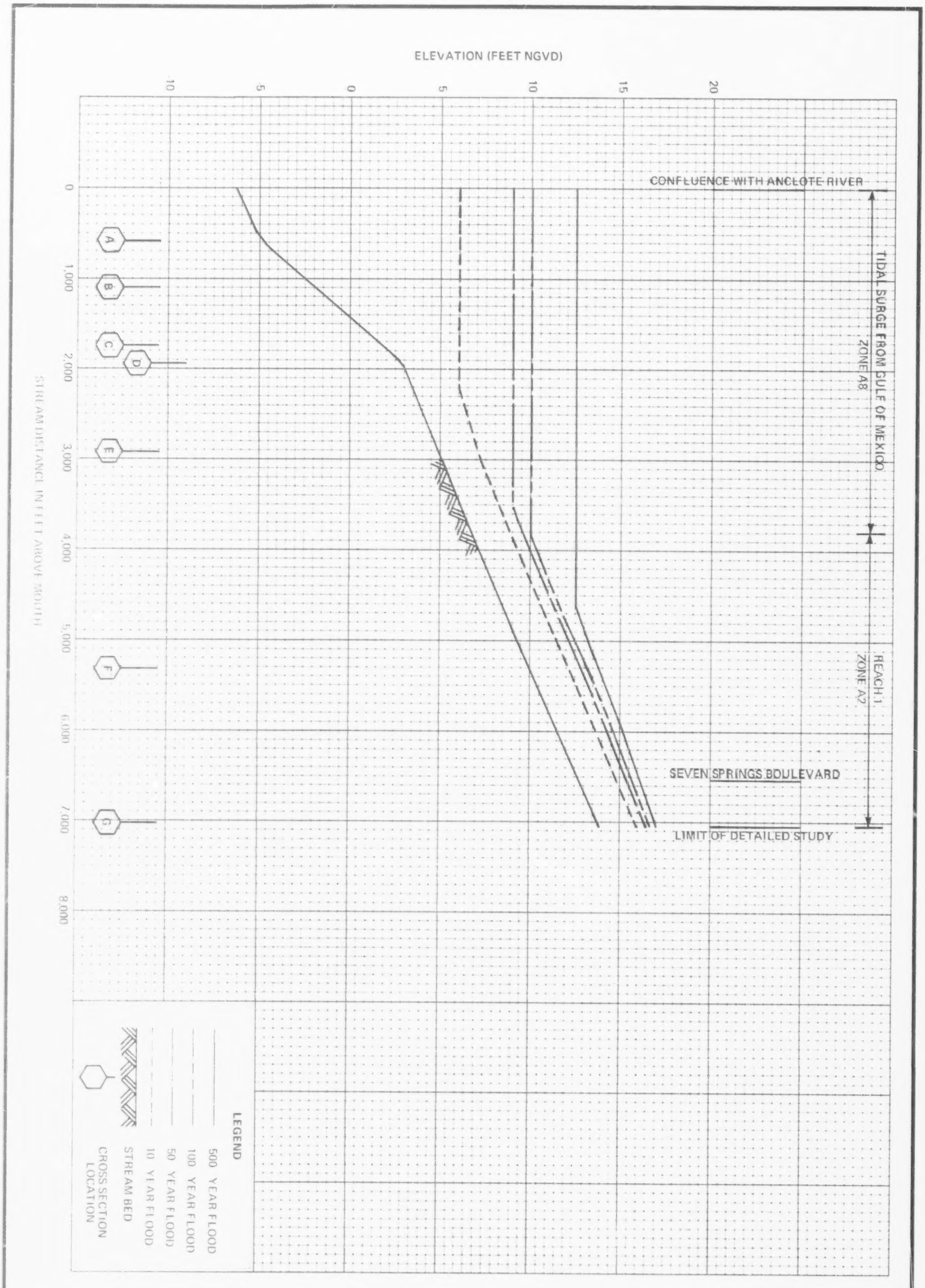
FLOOD PROFILES

ANCLOTE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

PASCO COUNTY, FL
(UNINCORPORATED AREAS)

01P



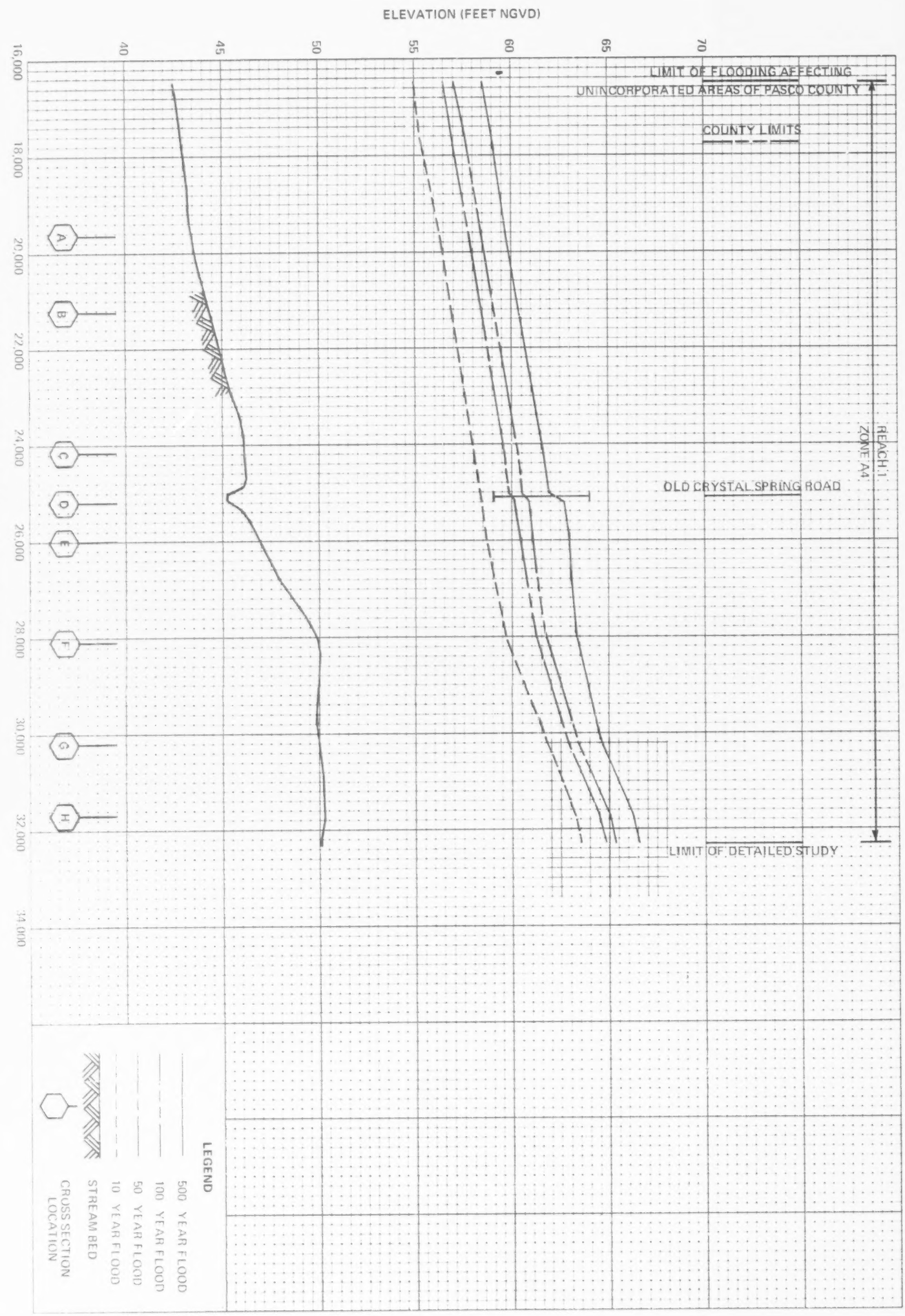
02P

FEDERAL EMERGENCY MANAGEMENT AGENCY

PASCO COUNTY, FL
(UNINCORPORATED AREAS)

FLOOD PROFILES

DUCK SLOUGH



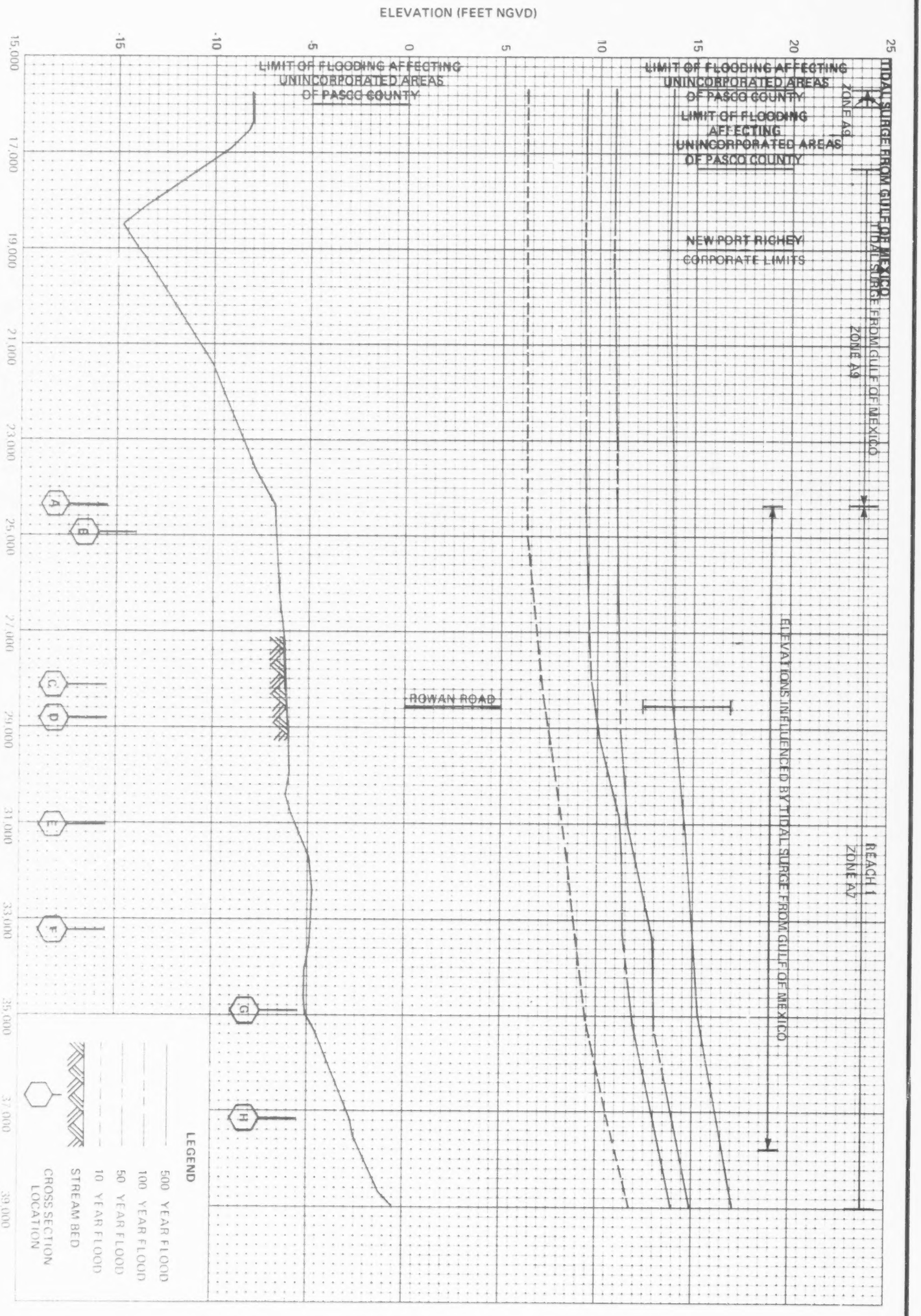
FEDERAL EMERGENCY MANAGEMENT AGENCY

PASCO COUNTY, FL.
(UNINCORPORATED AREAS)

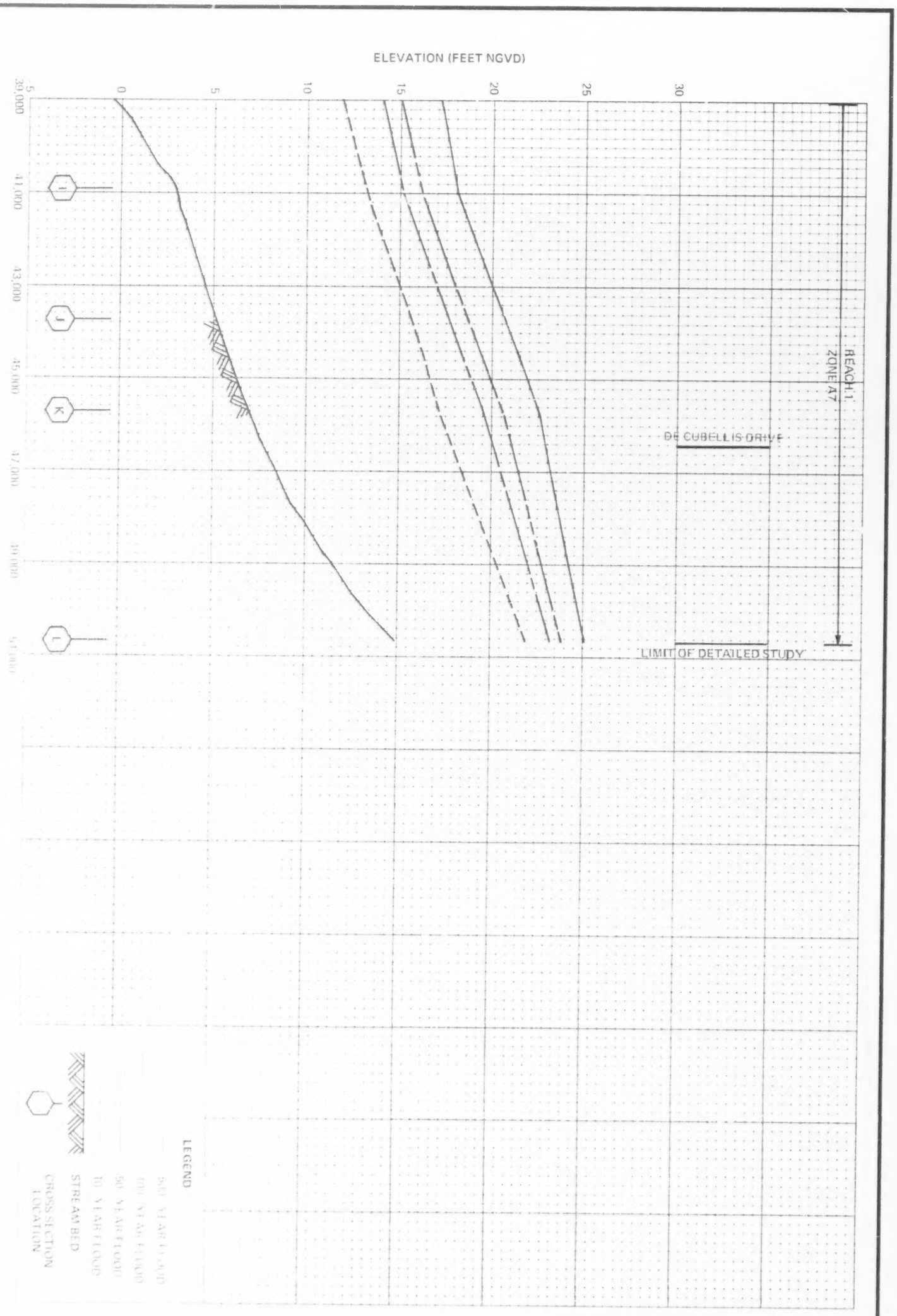
FLOOD PROFILES

HILLSBOROUGH RIVER

03P



04P	FEDERAL EMERGENCY MANAGEMENT AGENCY **PASCO COUNTY, FL** (UNINCORPORATED AREAS)	**FLOOD PROFILES** **PITHLACHASCOTEE RIVER**



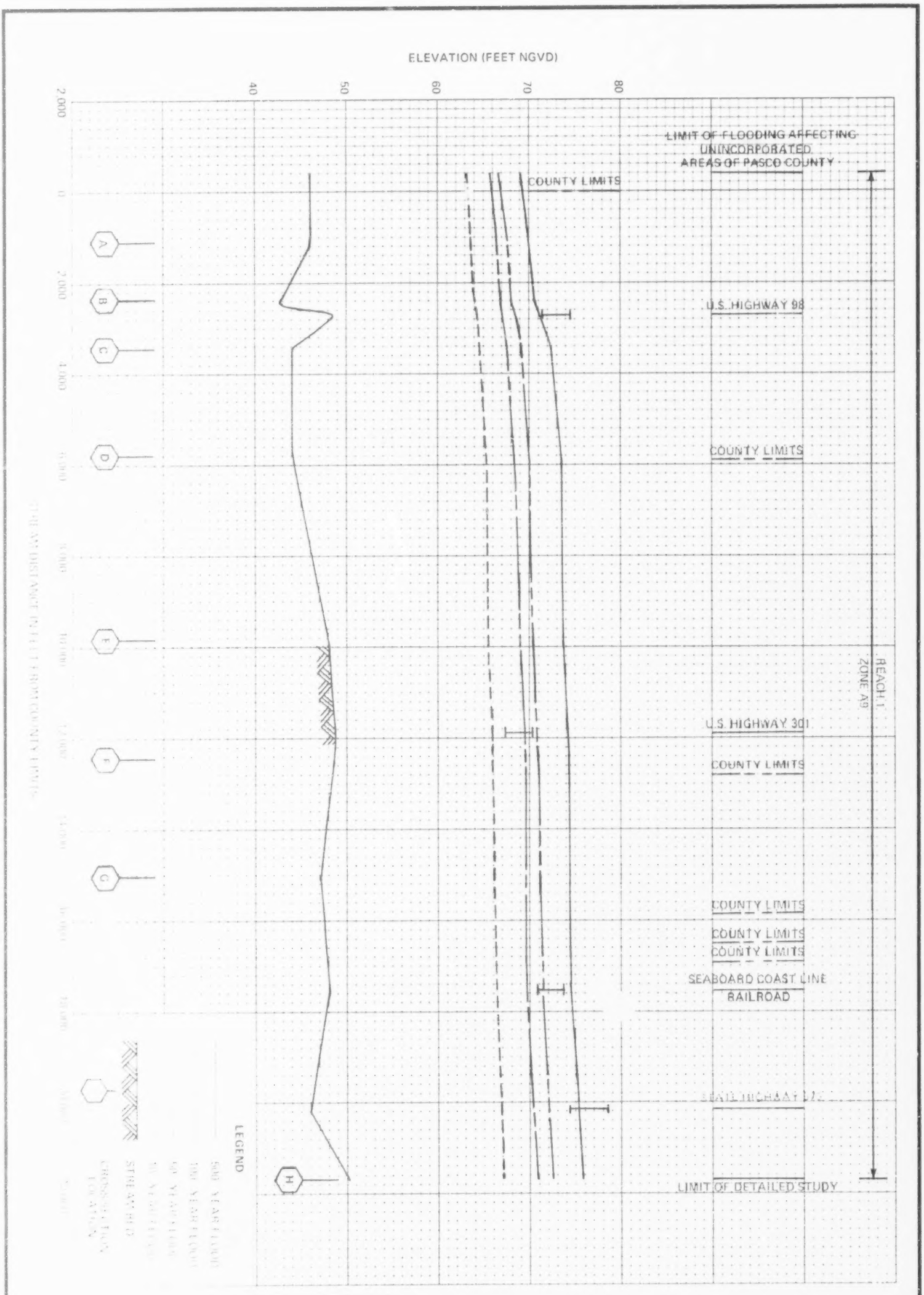
FEDERAL EMERGENCY MANAGEMENT AGENCY

PASCO COUNTY, FL
(UNINCORPORATED AREAS)

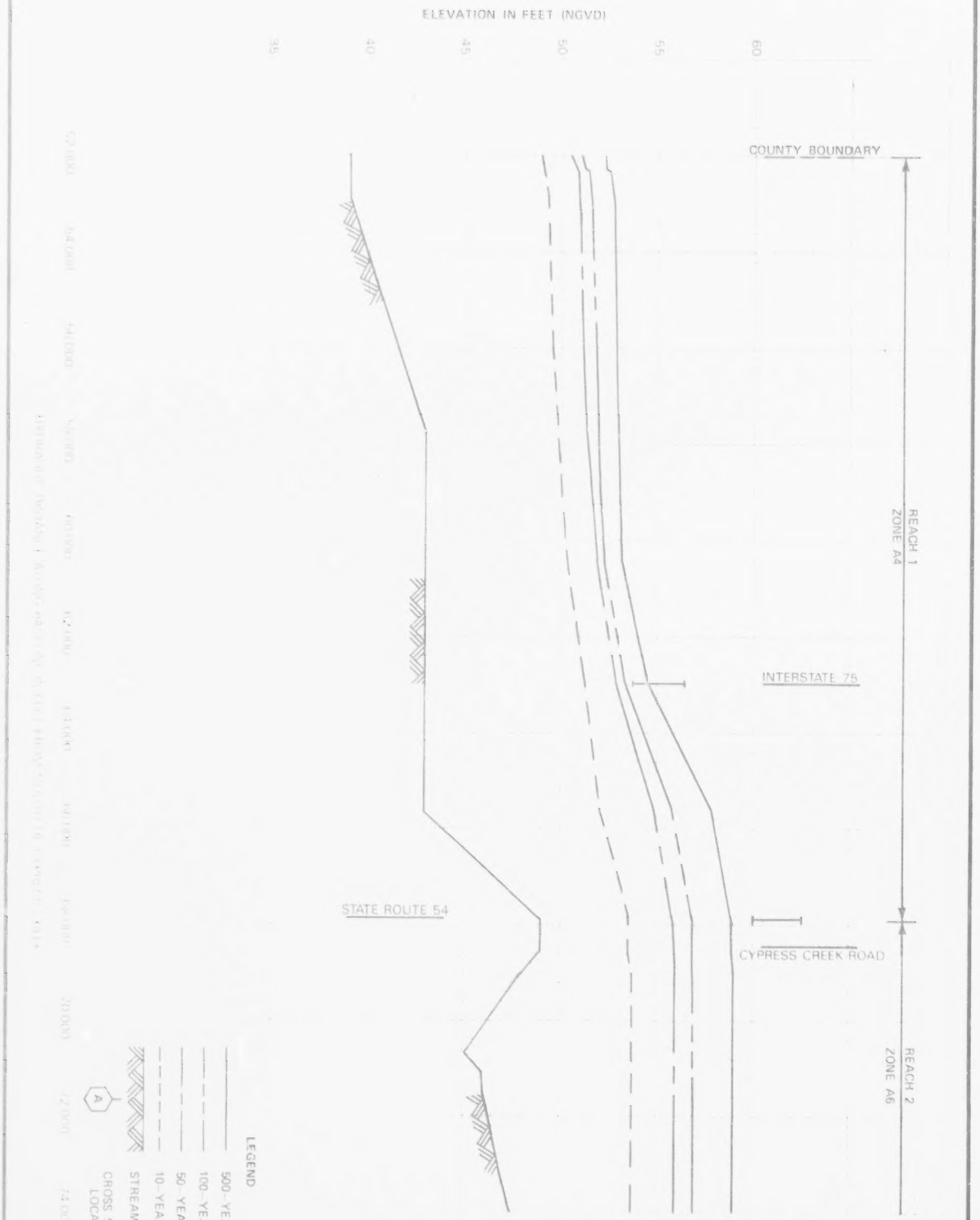
FLOOD PROFILES

PITHLACHASCOTEE RIVER

05P



09P	FEDERAL EMERGENCY MANAGEMENT AGENCY PASCO COUNTY, FL (UNINCORPORATED AREAS)	FLOOD PROFILES WITHLACOOCHEE RIVER



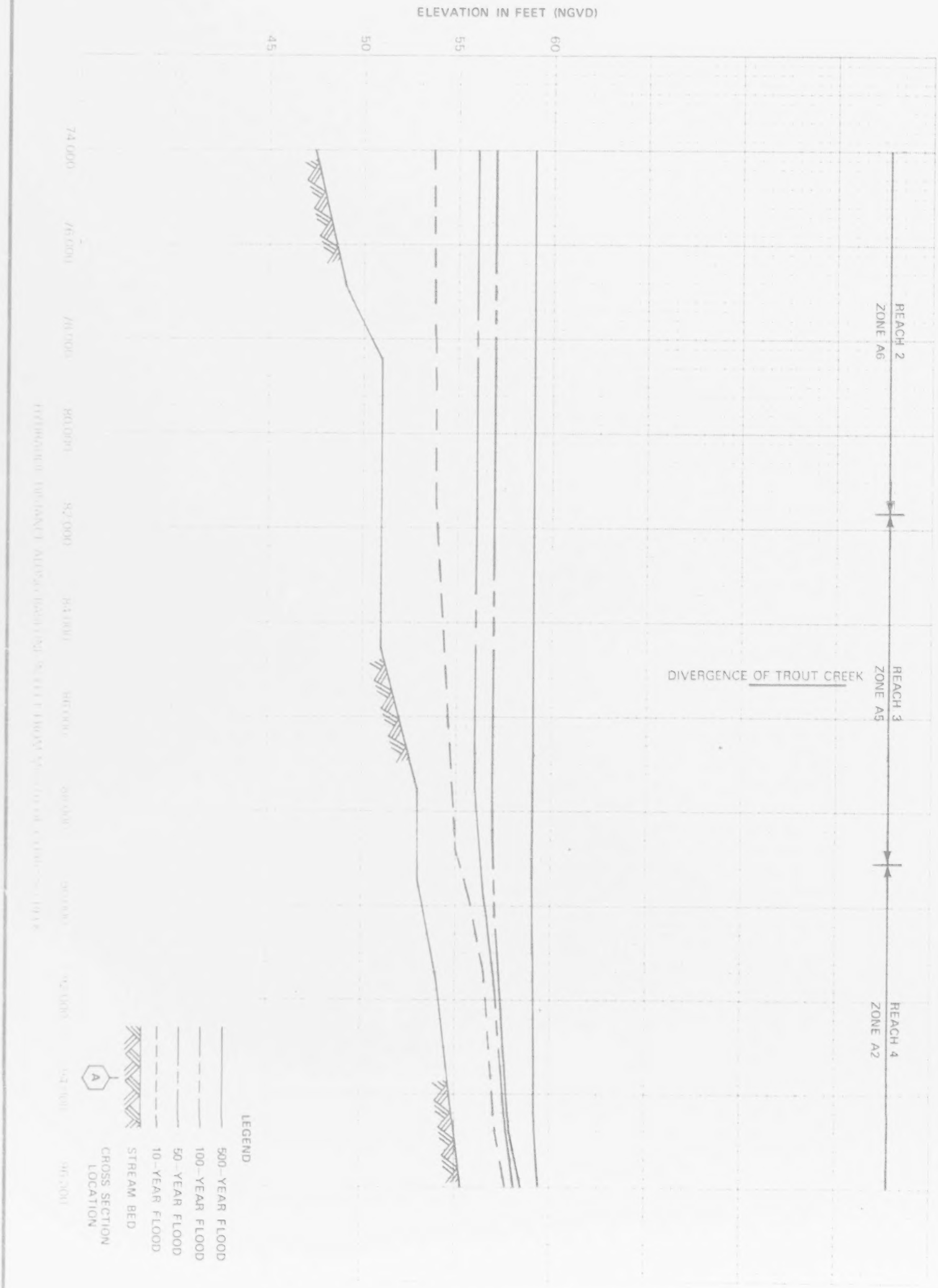
07P

FEDERAL EMERGENCY MANAGEMENT AGENCY

PASCO COUNTY, FL
(UNINCORPORATED AREAS)

FLOOD PROFILES

CYPRESS CREEK



08P	FEDERAL EMERGENCY MANAGEMENT AGENCY **PASCO COUNTY, FL** (UNINCORPORATED AREAS)	**FLOOD PROFILES** **CYPRESS CREEK**

FLOOD PROFILES

CYPRESS CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

PASCO COUNTY, FL
(UNINCORPORATED AREAS)

09P

FLOOD PROFILES

CYPRESS CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

PASCO COUNTY, FL
(UNINCORPORATED AREAS)

10P

REACH 1
ZONE A4

REACH 2
ZONE A3

COUNTY BOUNDARY

INTERSTATE 75

STATE ROUTE 54

ELEVATION IN FEET (NGVD)

60

55

50

45

40.000 42.000 44.000 46.000 48.000 50.000 52.000 54.000 56.000 58.000 60.000 62.000

HYDRAULIC BASELINE ALONG BASELINE IN FEET ABOVE TOWER HILLSBOROUGH FLOOD DETENTION AREA

LEGEND

- 500-YEAR FLOOD
- 100-YEAR FLOOD
- 50-YEAR FLOOD
- 10-YEAR FLOOD
- STREAM BED
- A — CROSS SECTION LOCATION

FLOOD PROFILES

TROUT CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

PASCO COUNTY, FL
(UNINCORPORATED AREAS)

11P

REVISED: 2-17-89

LEGEND

- 500-YEAR FLOOD
- 100-YEAR FLOOD
- 50-YEAR FLOOD
- 10-YEAR FLOOD
- STREAM BED
- (A) CROSS SECTION LOCATION

FLOOD PROFILES

TROUT CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

PASCO COUNTY, FL
(UNINCORPORATED AREAS)

REVISED - 12-88